Broadband radiometers

A range of broadband radiometers is operated at Chilbolton Observatory to monitor solar and longer-wavelength infrared radiation. The properties of this broadband radiation at the earth's surface provide a wealth of information on atmospheric conditions above the site.

A variety of different types of measurement are made at the site:

Wavelength range	• Shorter wavelength near-UV, visible and near-IR to measure radiation from the sun. • Longer wavelength IR to measure radiation emitted by the atmosphere and the earth's surface.
Measurement orientation	• Downwelling (sensor pointing vertically upwards) • Upwelling (sensor pointing vertically downwards) These provide information on the energy balance which results in warming or cooling.
Sky component	For the shorter wavelength radiation sensors can measure radiation from: • whole sky (total) • direction of the sun only (direct) • whole sky excluding the sun (diffuse) These provide information on the properties of clouds and aerosols present.

All measurements are made as an irradiance, i.e. power per unit area, falling on the detector. For the pyrgeometers the radiation emitted by the body of the instrument is a significant component of the measurement. The body temperature of the instrument must be measured to allow this component to be removed from the total measurement.

All instruments except the net flux radiometer are mounted on a Kipp & Zonen Solys 2 solar tracker. A shadow ball is mounted above the diffuse solar radiation sensor so that it is shaded by the shadow ball as the solar tracker follows the path of the sun. The direct solar radiation sensor is mounted on the side of the solar tracker so that it is always pointing in the direction of the sun. The unit has a pointing uncertainty of < 0.1°.

All instruments have in-built fans which force air over the window of the sensor to help reduce dew and ice and dry the instrument after precipitation. All the radiometers and the solar tracker have an operating temperature range of -40 – +80°C.

The maximum measured irradiance values are 4000 Wm^{-2} for all pyranometers except those incorporated into the net flux radiometer and for the pyrheliometer, 2000 Wm^{-2} for

pyranometers in the CNR4 net flux radiometer and 250 Wm^{-2} net radiation (before the correction for the instrument temperature) for the pyrgeometers.

The specifications of the broadband radiometers are as follows:

Radiometer details			
Instrument	**Measurement**	**Wavelength range (50% points)**	**Uncertainty**
Kipp & Zonen CM21 pyranometer	Downwelling total visible radiation	305 – 2800 nm	±2% of daily total irradiance
Kipp & Zonen CG4 pyrgeometer	Downwelling total IR radiation	4.5 – 42 μm	±3% of daily total irradiance or ±7.5 Wm^{-2} on a single measurement
Kipp & Zonen CMP21 pyranometer	Downwelling diffuse radiation	285 – 2800 nm	±2% of daily total irradiance
Kipp & Zonen CHP1 pyrheliometer	Direct solar visible radiation	200 – 4000 nm	±1% of daily total irradiance
Kipp & Zonen CNR4 net flux radiometer	Upwelling and downwelling visible and IR radiation	300 – 2800 nm (visible) 4.5 – 42 μm (IR)	±5% of daily total visible irradiance ±10% of daily total IR irradiance

Data Archive	
Sampling rate	10 seconds time interval for all expect net flux radiometer, which is 1 second.
Data storage	Continuous recording in daily files
Archive data format	netCDF
Archived to British Atmospheric Data Centre	http://badc.nerc.ac.uk/
BADC datafiles	cfarr-radiometer-vis_chilbolton (total and diffuse downwelling visible radiation) cfarr-radiometer-ir_chilbolton (downwelling IR radiation) cfarr-radiometer-vis-direct_chilbolton (direct solar visible radiation) cfarr-net-flux-radiometer_chilbolton (upwelling and downwelling visible and IR radiation from net flux radiometer)

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